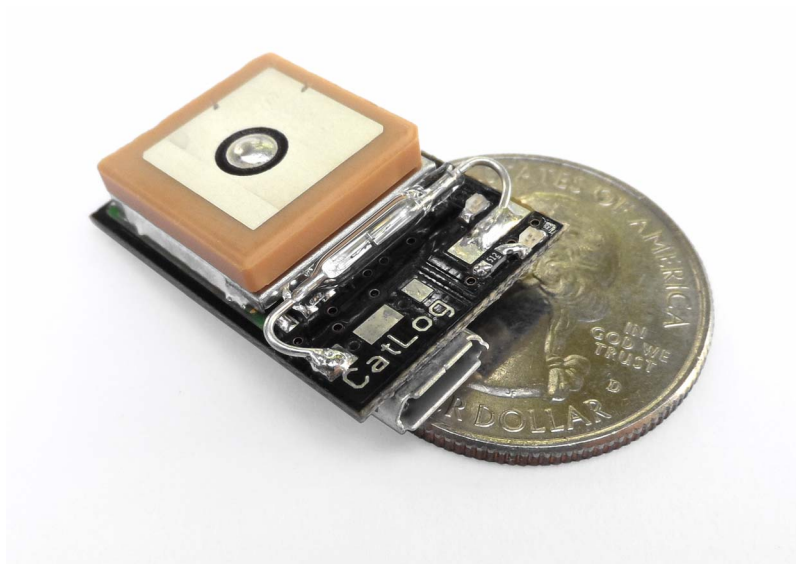


CatLog-S2 - User Manual

With ThermoSeal™



Revision: August 12, 2015

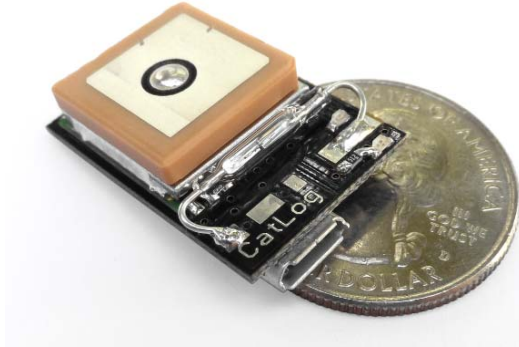


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1. Introduction

1.1 CatLog-S Features



Used in thousands of GPS tags around the world CatLog-S became the standard GPS data recorder for wildlife biotagging.

Generation 2 of the CatLog-S has been specifically developed for scientific use while still maintaining an excellent performance to cost balance.

Its low power consumption combined with small dimensions, low weight and high accuracy makes it an ideal device for domestic and wildlife animal observation.

The device will record the position in an adjustable time interval. The movement profile can later be displayed on a map or exported to use with other software.

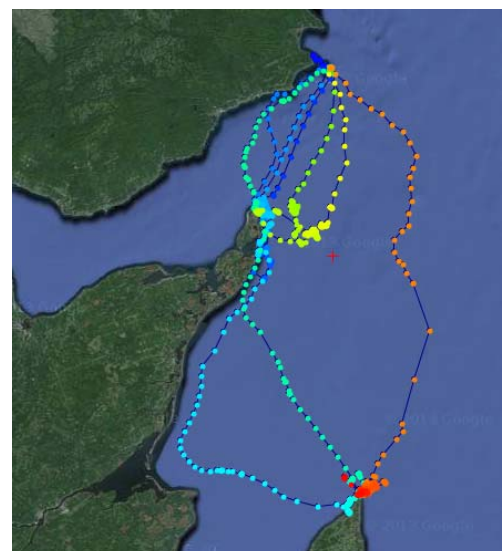
Optimized for scientific use, CatLog-S offers the following features:

- Magnetic switch to activate and deactivate it
- ThermoSeal™ protection withstands seawater and tough conditions
- Optimized weight and operation time by scalable battery size
- Lots of configuration options to get the best results for your project needs.
- Retrieval option
- Advanced scheduler (dual time table)
- Ready for alternative energy supply (self containing system)



The recorded data is stored in an open text format that can be used by most 3rd party programs.

However, CatLog has also its own visualization software. This allows the user to analyze the captured data as well as to apply multi-level filters or export only certain portions of the whole data set. It also allows visualizing position accuracy estimates which is one specific feature of the Gen2 CatLog.



1.2 Specifications

Specifications like size, weight, runtime can be found in the datasheet "CatLog-S2 – Data Sheet" located on our website:

www.mr-lee.com → Science Line → Support → Manuals & Instructions

Since the device can be customized to the customer requirements the version you have may not be reflected by the general data sheet.

1.3 Support and Help

You can get in contact with the technical support by sending a mail to info@mr-lee.com

Website: www.mr-lee.com

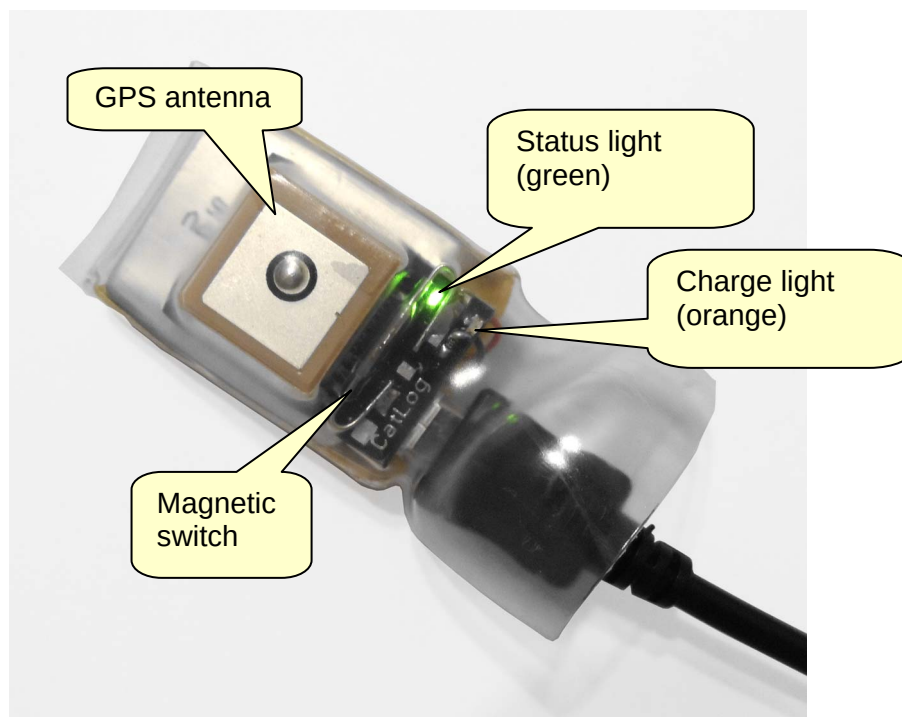
2. Device Hardware

2.1 Device Overview

The CatLog-S GPS recorder has a very compact size. The biggest part is usually the battery.

If the device is equipped with a ceramic patch antenna (as shown in the picture) care must be taken that it faces up into the sky for optimal performance. Chip or wire antennas will have no orientation requirements.

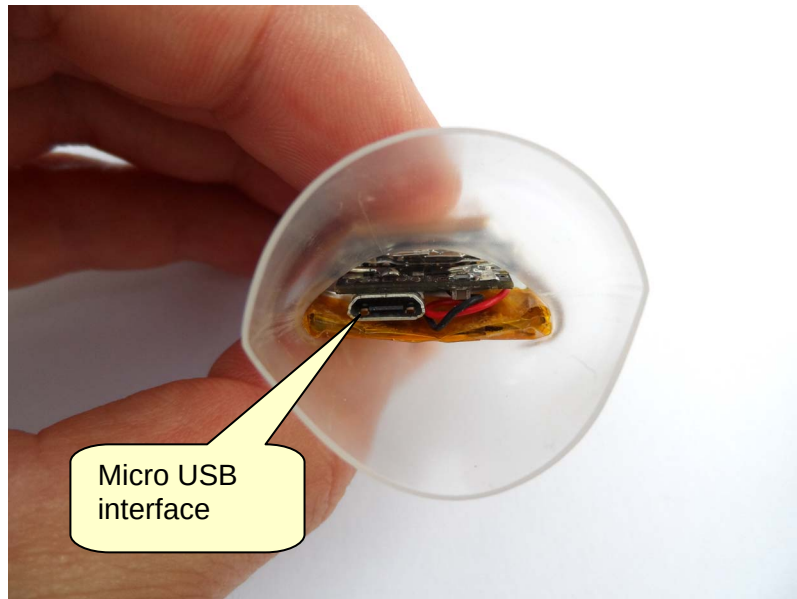
There are 3 control / status elements on the device: a switch to turn it on and off, 2 lights to inform about the operation status.



The lights will show you the status:

Status	Green light	Orange light
Battery charging	-	On
Device connected to computer	On	-
Device is switched on	Flashes rapidly for 1s	-
Device is switched off	On for about 2s	-
Device enabled	Blinks every 8s	-
Device is acquiring position	-	Blinks every 8s (depends on HW version)
Device is storing position	Flashes quickly 2 times	Flashes 2 times (depends on HW version)
Battery empty	Flashes slowly 2 times	-

A Micro USB interface is used for charging and communication with the computer, see image below. See section “Charge and Communicate” for more details.



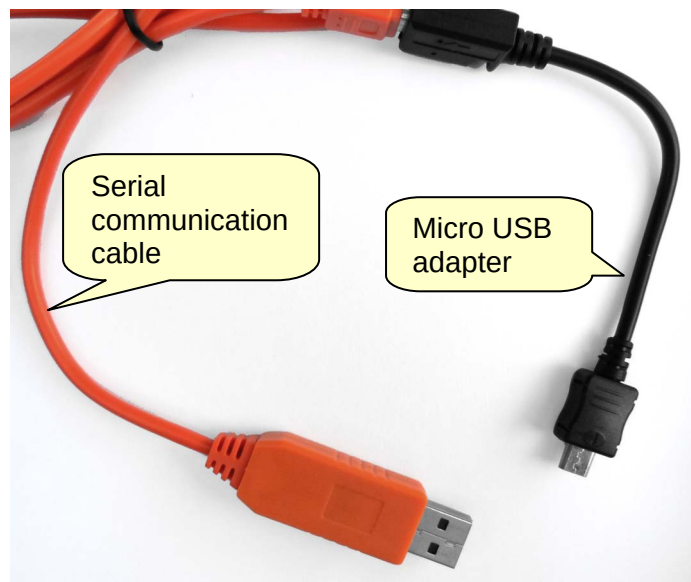
2.2 Charge and Communicate

The CatLog-S is equipped with a Micro USB interface. For charging any Micro USB cable can be used. Charging will start automatically, the charge light (orange) will turn on while the battery is charged and turn off when the battery is fully charged.



Note: Do not store the device with a discharged battery. The battery will get permanently damaged.

To communicate with the device a special cable is required. It interfaces the serial interface of the GPS to the computers USB port. A software driver needs to be installed (see section USB cable driver). Below is a picture of the serial communication cable with a Micro USB adapter.



In some cases (e.g. battery completely drained) it might require you to switch the device manually ON before you can communicate with it. Depending on battery capacity it may also take some minutes to reach a charge level that allows the device to operate.

2.3 Switch Device On and Off

CatLog-S is equipped with a magnetic switch. Take a permanent magnet and place it in the proximity of the switch (see Device Overview, location can vary). The switching zone is left or right of the center. To get familiar with the switching zones and correct distance simply swipe the magnet across the switch. **Please do not touch the switch directly with a magnet !**

The green light will come on immediately after the switch will sense a magnetic field. But the device will turn ON only after the switch is closed for a while. This will be signaled with a rapid flashing of the green status light.

If the magnet seems not to work change the polarity of it.

3. Software Setup

The latest version of the software is always available from the Mr. Lee website (www.mr-lee.com → Science Line → Support).

Software is only available for Windows operation systems.

The software package contains the CatLog GPS Control Center and drivers. Unpack the zip file in a dedicated directory. Start SETUP.EXE.

Before you can start the Control Center and work with the device two drivers need to be installed:

- a) Driver for the USB cable (PL2303)
- b) In some cases (if not covered by the SETUP program): Driver for serial communication (SCOMM32)

The following sections will give you more details about this.

3.1 USB Cable Driver

The PL2303 USB cable driver installation depends on the operation system you are using. If you are unsure, open the computers Control Panel, Click on System. System Information panel will open; look at section System, System Type.

Once you know if you have 32 or 64bit OS when open the folder "PL2303_driver" of the CatLog Control installation package.

All Windows 64 bit operating systems including Windows 10:

1. Unplug all USB-To-Serial adapters
2. Double click on the installer "PL2303_64bit_Installer.exe"
3. When it prompts you, plug in one (1) of your USB-To-Serial adapters and click "Continue".
4. Reboot your computer

All Windows 32 bit operating systems from XP up:

1. Unplug all USB-To-Serial adapters
2. Run the installer program "PL-2303_Driver_Installer.exe".
3. If it offers a choice to remove the driver, then select to remove the current driver. Then run the installer again to install the correct driver.
4. Reboot your computer

3.2 Serial Communication Driver

Note: Normally installed with setup program. Skip this section.

Installation procedure of SCOMM32.OCX (Serial Communication Driver) depends on the operation system.

Step 1: Copy the ocx into windows system folder.

- a) Windows 32 bit: to c:\windows\system32 (requires Admin rights)
- b) Windows 64 bit: to c:\windows\syswow64 (requires Admin rights)

Step 2: Open command prompt

- a) Windows 7 or Vista:
 - Select Start > All Programs > Accessories
 - Right-click on "Command Prompt" in the Accessories
 - Click "Run as Administrator"
- b) Windows 8:
 - Open the "Quick Link" menu (by holding down the Windows 8 logo key and pressing the X key)
 - Select "Command Prompt (Admin)"
 - Select "Yes" to allow changes
- c) Windows XP: skip this step

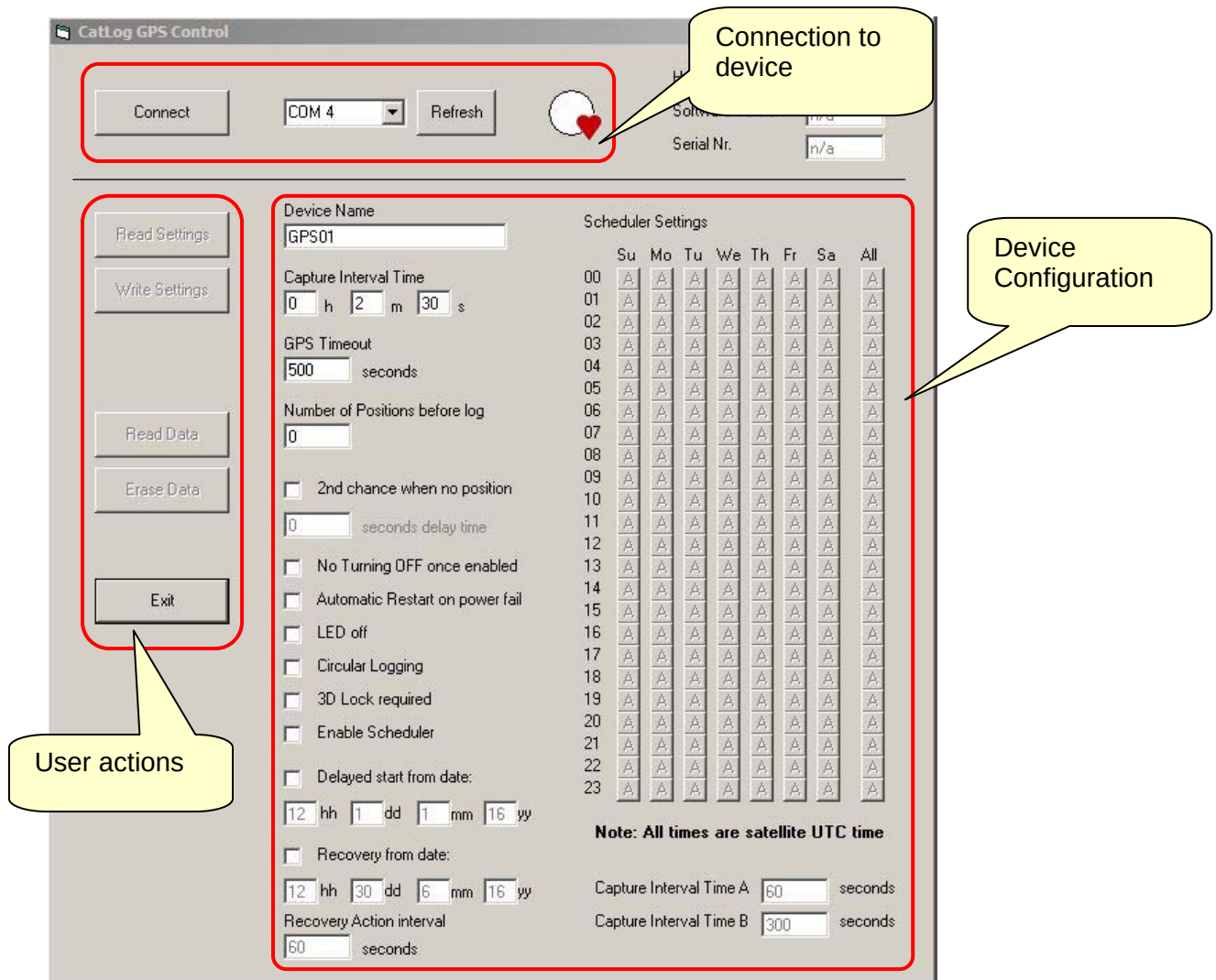
Step 3: Register OCX

- a) 32bit Windows Version: enter the following string in command prompt:
c:\windows\system32\regsvr32 c:\windows\system32\SComm32.ocx
- b) 64bit Windows Version: enter the following string in command prompt:
c:\windows\syswow64\regsvr32 c:\windows\syswow64\SComm32.ocx
- c) Windows XP: In versions of Windows prior to Vista, or with User Account Control (UAC) turned off in Windows Vista, 7, or 8, ActiveX files (such as .dll or .ocx) can be registered by double-clicking on the filename in Windows Explorer ("File Explorer" in Windows 8). If opening, running, or double-clicking on a file with a .dll extension (Dynamic Link Library) or an .ocx extension (OLE Control Extension) brings up an "Open With" screen: click "Select the program from a List" and click OK > click the "Browse" (or "Other") button on the lower right of the screen > progressively select directories and change the "Look-in" box on the next screen to C:\Windows\System32\regsvr32.exe > double-click on regsvr32.exe (or click the Open button) > verify that "Microsoft Register Server" is highlighted in the Programs list > verify that a check mark is in the "Always Use" box on the lower left of the Open With screen > click the OK button on the "Open With" screen. A message should appear indicating that the registration succeeded. Click the OK button on the RegSvr32 message screen.

4. Control Center

The CatLog GPS Control Center will be your main tool to work with the GPS device. It is used to configure the functionality and read the recorded data.

Below an overview of the main screen.



4.1 Connecting GPS Device

Step 1: Plug in PL2303 serial communication USB cable, Click „Refresh“, Select COM port (usually highest one). This step only needs to be done once per session.

Step 2: Connect device to USB cable. Check if green light turns on and stays on. If not activate switch so that device turns on (green light stays on).

Step 3: Click “Connect”. Heartbeat indicator should turn red, buttons in the action section should be enabled after some seconds, device information (hardware, software, serial) should be updated.

4.2 Disconnecting GPS Device

The former „Connect“ Button turned into „Disconnect“. Once you are done with the device, click “Disconnect”. You can now unplug the device from the USB cable. If you plan to work with other devices do not remove the USB cable from the computer. You can simply plug the USB cable into the next device. Continue with Step 2 of Section “Connecting USB Device”.

4.3 Device Configuration

You will find that you can already make changes to the device configuration without having a device actually connected. This concept allows to configure multiple devices with just a few clicks.

You can either press the “Read Settings” button to read the settings of the connected device or do the editing without the actual device settings.

Press “Write Settings” to deploy the settings to one or more devices (after disconnecting and connecting following devices).

The CatLog GPS device is highly customizable. Please refer to the following sections that explain the different operation modes and options.

4.3.1 Operation Modes

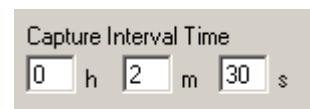
The device supports 2 different operation modes:

- Standard Interval Mode
- Weekly Scheduled Mode

4.3.1.1 Standard Interval Mode

Use this mode if energy conservation is not the primary concern.

This mode wakes the device periodically and takes a position. The time is defined by “Capture Interval Time”. The interval is not synchronized, meaning it is free running.



Capture Interval Time					
0	h	2	m	30	s

4.3.1.2 Weekly Scheduled Mode

This mode allows to conserve energy by tailoring the operation time.

Based on a weekly calendar the GPS device can be enabled for certain hours a day or certain days a week. This option will make the system acquire the GPS date and time to synchronize the operation.

When the GPS is enabled by the scheduler it will use the "Capture Interval Time A" or "Capture Interval Time B" to log positions, depending on the settings in the scheduler matrix.

The example to the right will use Interval time A from 00:00 to 00:59, Interval time B from 01:00 to 02:59 and disables the device from 03:00 to 04:59.

	Su	Mo
00	A	A
01	B	B
02	B	B
03	-	-
04	-	-

Care must be taken that the capture interval time is shorter than the available time window defined in the scheduler (e.g. time window set to 1 to 2 o'clock = 1 hour, capture time interval needs to be smaller for example 45min).



Note: the GPS time is UTC time, all settings in the scheduler will use UTC time and not local time. You need to adjust the scheduler based on your local time if required.

4.3.1.3 Options for Accuracy and Energy Consumption

This section will explain you the options responsible to balance between accuracy and energy consumption. It will try to make the relations transparent so that you can decide what settings are the right ones for your case.

4.3.1.3.1 GPS Timeout

The GPS receiver requires some time depending on reception conditions to acquire the current position. Under some circumstances the GPS receiver may take a long time to get a position, e.g. when device is under water. Since the receiver will operate in the highest power state to scan the GPS satellite signals the battery will drain significantly.

To prevent this the time to get a valid position can be limited. This is set using the **GPS Timeout**. This time should not be shorter than 60s because this option can limit the receiver to a point there no position at all can be acquired keeping the GPS device in an unproductive endless loop.

4.3.1.3.2 Second Chance when no Position Available

If reception conditions are unfavorable and the GPS device can not get a valid position within the GPS Timeout time the device can be configured to try it a second time. This is especially useful if the main Capture Interval time is long and the GPS device would only log a few positions every day. To have such kind of backup, enable option "**2nd chance when no position**". Now the time defined by "Retry / 2nd chance delay time" will enable the GPS device allowing the system to gather a position outside the regular capture interval.

4.3.1.3.3 3D Position Lock required

Once the GPS device is receiving valid signals and is able to determine the current position several options are available to increase the accuracy of the position. In general terms, the longer the GPS receiver is enabled the better the position will get but the more energy is required.

One option to significantly increase the accuracy is to select "**3D Lock required**". For this 3 dimensional position at least 4 different satellites are required. For a "simple" 2D position only

3 satellites are required. The GPS receiver usually starts searching for one satellite, reads the date and time and then searches for possible other satellites based on a predicted constellation. So the normal sequence is 2D lock and if more satellites are received 3D lock and then switch to tracking the satellites with the best signal.

4.3.1.3.4 Number of Positions before Logging

An other option for accuracy improvement is to increase the “**Number of Positions before log**”. Once the minimum number of satellites (see 2D/3D lock) is met the GPS device will count the number of valid positions until the position is recorded. This allows the GPS receiver to find enough satellites to improve the calculation of the current position.

4.3.1.4 Additional Options

Device name: allows to assign each device a specific name. This comes handy if multiple devices are used. An identification is also the serial number of the device. It is unique for every device and cannot be changed.

No turning OFF once enabled: This options prevents the device from being switched OFF once it is switched ON. The device will need to be connected to the control program and the option disabled before it can operate in the conventional way. Preventing the device from getting switched off is useful for situations were either there is a danger of accidentally switching the device off (e.g. vibrations during operation) or disabling the device on purpose is prevented (stealth observation). Note: if this option is enabled the device will turn OFF after disconnecting from the computer.

Automatic restart on power fail: If power fails the device will normally go into standby mode and will wait to get switched on. Enabling this option, the device will go into operation mode once power gets available. This option particularly makes sense if powered by secondary energy sources like solar energy.

LED off: Enabling this option will disable the LED lights once the device is in operation mode. LED lights will still be visible during enabling, disabling and charge & communication. This option will save energy as well as will prevent disturbances while in operation.

Circular logging: normally the GPS device will record positions until the memory is full. With this option enabled the system will start erasing earlier positions once the end of the available memory is reached.

Delayed start: This option will switch the device ON at a certain hour of a specific date. Until this date the device is in off-state and conserving energy. You do not need to manually switch the device ON for activating this function. If the device is turned ON manually this option has no effect.

Recovery: This option will stop regular device operation at a certain date. The device will go into recovery mode and conduct a recovery action (e.g. flashing LED) in the specified action interval. This option will override the “LED off” option.

4.4 Read Recorded Data

Click on “Read Data” to read the stored position data of the connected GPS device. A dialog will open to choose a file name and output format. So far only CSV Excel text table format is supported.

Data is then be read from the device and decompressed. Depending on the amount of positions this will take a significant time. Since the device is using so called circular memory architecture it will not immediately recognize the end of the data stream. Therefore a stop button is present. If you see no increase of the position numbers for some seconds you can stop the download. However, if you have enabled “Circular Recording” you should wait until the software determines the end of available data.

4.5 Erase Device Memory

To erase the data memory, press “Erase Data”. For safety purpose a dialog will ask you if you are sure.



Important: erased data can not be restored.

5. GPS Data Viewer

The GPS Data Viewer is a standalone program. The latest version of it is also available from the Mr. Lee website (www.mr-lee.com → Science Line → Support).

For visualization and data analysis of recorded GPS data the GPS Data Viewer offers a lot of features while trying to stay as easy as possible. The viewer can utilize both Google and Bing maps (see configuration). It requires an active internet connection.

The following sections will guide you through the features.

5.1 Installation

Download and unzip the program. No installation is required.

5.2 Overview

Below you can see the main screen of the viewer. Controls are arranged in specific sections as indicated.

The screenshot shows the GPS Data Viewer interface. It features a map of North America and the surrounding oceans. The interface is divided into several sections:

- User actions:** A vertical panel on the left containing buttons for Load, Save, Config, and Exit.
- Display options:** A section below the user actions panel with checkboxes for Show route, Show points age, Show tolerances, and Show invisible points. It also includes a dropdown for 'Min. distance between points' (set to 250 m) and a checkbox for 'Autodetect dist.'.
- Map area:** The central map area showing geographical data points and a red crosshair.
- Data and Filtering section:** A table at the bottom of the interface displaying GPS data points. It includes columns for Apply Filter, Min, Max, PointDate, PointTime, Lat, Lon, Alt, Sat, HDOP, and PC. The table is filtered to show points from 6/3/2014 to 6/5/2014.

Additional information on the left side of the interface includes a 'Position age colors' legend and statistics: Total rows in the file: 8333, Minimum distance 68418 m, Points: 42 (8333), Enabled points: 42.

Apply Filter	Min	Max	PointDate	PointTime	Lat	Lon	Alt	Sat	HDOP	PC
	6/3/2014	02:12:49	45.459702	-73.750656	-12.14	3	0.7	1.1		
	8/1/2014	18:49:12	54.141792	11.65062	453.99	10	3	3.1		
Clear Filter	Enabled	6/3/2014	05:46:44	48.533569	-64.225937	138.99	4	2.4	2.6	
		6/3/2014	17:04:10	47.923462	-64.473419	10.02	5	1.2	1.4	
		6/4/2014	11:32:00	48.497131	-64.137863	-4.23	6	1.2	1.5	
		6/5/2014	03:09:07	47.91967	-64.486237	9.18	5	1.4	1.7	
		6/5/2014	06:31:39	47.341099	-64.81768	1.81	4	1.4	1.7	

5.2.1 Map Area

The map area shows data points according to filtering and display options. The following controls are available:

- **Zoom-in:** Rotate mouse wheel forward
- **Zoom-out:** Rotate mouse wheel backward
- **Move map:** Hold right mouse button and move mouse
- **Select area of data points:** Hold Shift key, left click mouse button and move mouse pointer. See more details in Filtering section.

5.2.2 User Actions

Load: here you select the GPS data file (CSV format) which was saved by CatLog Control Center to visualize.

Save: Writes data to CSV file. Only data points passing all filter criteria are saved.

Config: Opens a configuration window. Following options are present:

- **Maps:** Choose between Google Maps and Bing Maps
- **View:** Selects the map style (Satellite images, graphical map or hybrid view)
- **Dot size:** small or regular dots for data point display
- **Route (connection between data points)** color and width
- **Maximum number of points:** defines the maximum number of data points that will be displayed with all features. Since all data points need to be uploaded to the map service this will considerably slow down the program. If the filter settings result in a data point count exceeding this number certain display features will be disabled.

5.2.3 Data Filtering

Once a dataset is loaded all positions will be displayed on the map and you will get a table with all data points below the map screen.

With an increasing number of data points you may wish to reduce the number of relevant points. Also for certain analysis procedures it might be important to look only at data points with certain characteristics.

You can basically apply two different types of filter criteria:

- **Numerical filter:** filter criteria is set in the data table
- **Spatial filter:** filter criteria is set on the map

Both filtering types can be combined. The following section will explain each type in more detail.

Once a filter criteria is set or changed, it will only become effective if the Button “Apply Filter” is pressed.

To remove all filter criteria (both numerical and spatial) press the button “Clear Filter”.

5.2.3.1 Numerical Filtering

All available data points are listed in the data table. For each column a filter range can be defined. Initially the filter min/max values will show the lowest and highest value present in the current data set. If you click into each min/max field you can change the upper or lower limit for each column. Only data points that are in between the minimum and the maximum value will pass the filter.

So for example you want to remove all data points with bad reception conditions. Columns HDOP and/or Tolerance would need to be filtered. Click in field HDOP min, select 0. Click in field HDOP max, select 2. Click button "Apply Filter". Now only data points with an HDOP value of 0 to 2 will remain.

Min	.750656	-12.14	3	0	1.1	2.1
Max	65062	453.99	10	2	3.1	9

Enabled	h	Alt	Sat	HDOP	PDOP	Tolerance
☒	225922	136.17	3	1.8	2.1	5.4
☒	473419	10.02	5	1.2	1.4	3.6
☒	137863	-4.23	6	1.2	1.5	3.6
☒	486237	9.18	5	1.4	1.7	4.2

Additionally every data point can be manually disabled by removing the check mark in column "Enabled".

Short overview of available data columns other than position and date:

Sat: Number of satellites present for this data point. The higher the more accurate

HDOP: Horizontal dilution of precision: Quality indicator of position (2D): The lower the more accurate

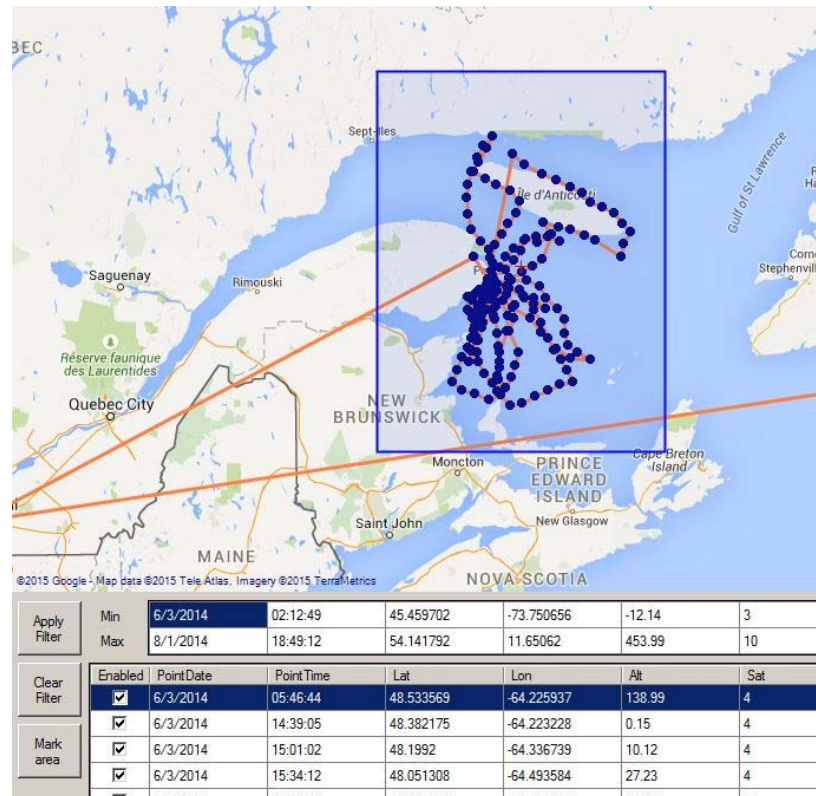
PDOP: Position dilution of precision: Quality indicator of position (3D): The lower the more accurate

Tolerance: Estimated tolerance radius of position in meters; derived from quality indicators. The lower the better.

5.2.3.2 Spatial Filtering

Spatial filtering applies to data points on the map. An area is selected that contains data points of interest. All data points not in the area are filtered out.

To apply a spatial filter you have two ways. One is to press button "Mark area" and then move the mouse pointer to one corner of the area, right click the mouse and drag the pointer to the other corner of the area. The other way is to hold the Shift key while doing the same.



The spatial filter becomes effective after the button “Apply Filter” is pressed. To remove the area selection simply right click on the map.

The status window on the lower left hand side will show you how many data points remain after setting the filter.

Another kind of spatial filter is sitting in the display options. The “minimum distance between points” limits the number of data points on the map based on the map scale. For example if you have to zoom level set to 0 (whole world view) two positions that are 10 meters from each other are not possible to be displayed as two separate dots and can be represented by just one dot.

The value of minimum distance tells the program that all points with a distance lower than the defined value will be filtered out. The value can be selected manually or automatically based on the map scale. Button “Update Map” needs to be pressed each time the value was changed manually or the map was zoomed in/out.

To reset all spatial filters select a value 0 for “minimum distance between points”, disable “autodetect”, press button “update map”, press the button “Clear Filter” .

5.2.4 Display Options

There are certain options to change the display of data points. Note that some features are only feasible if the number of data points is below the **Maximum number of points** defined in the configuration. The current number of data points passing all filter criteria is visible in the status window on the lower left hand corner.

Show route: connects data points with a line

Show points age: Color codes each data point based on the date and time. Oldest position is dark blue, newest position is red. This simplifies the understanding of more complex movement profiles.

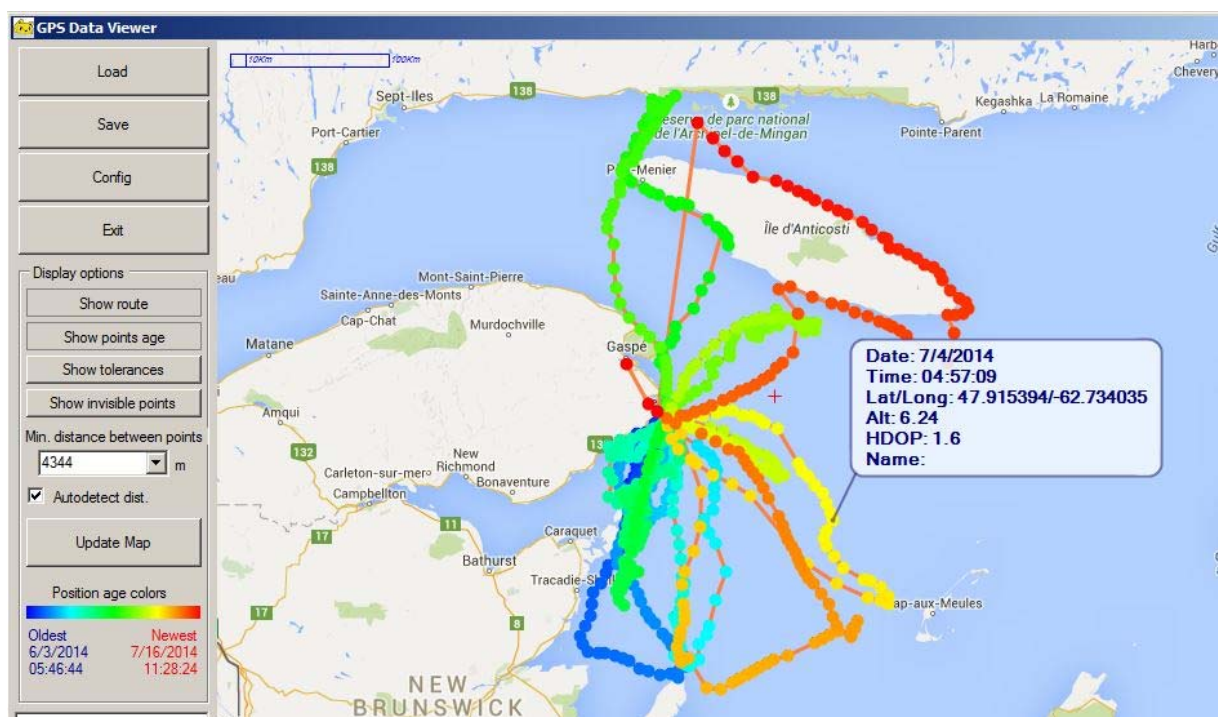
Show tolerance: Shows a tolerance circle for each position. Only useful with highest zoom level. See explanation of “Tolerance” column for details.

Show invisible points: displays points that are not passing filter criteria as an “X”.

Minimum distance between points: see spatial filters

Changes become only effective after pressing the button “Update Map”.

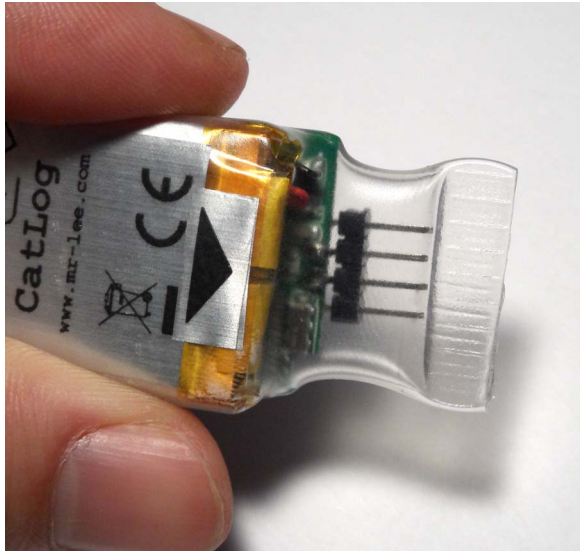
See also “Configuration” options for how to change colors and sizes of data points and lines.



Summary of each data point is shown if you move the mouse pointer on it.

6. ThermoSeal™

One key feature of the CatLog-S is the ThermoSeal enclosure that offers the best environmental protection for the least weight. It is a special heat shrink tubing with outstanding characteristics.



ThermoSeal™ Features:

- Provides reliable water tightness and is absolutely corrosion and pressure resistant.
- Reusable seal, just heat it up to open it and seal it again with heat !
- Sufficient wall thickness to mechanically protect the device
- Sticks to tape for universal deployment
- Allows to create special attachment fixtures
- Cheap, clean, economic, simple !

6.1 Sealing Process

Below follows the description of the sealing process. We have also a video available to show the workflow and details.

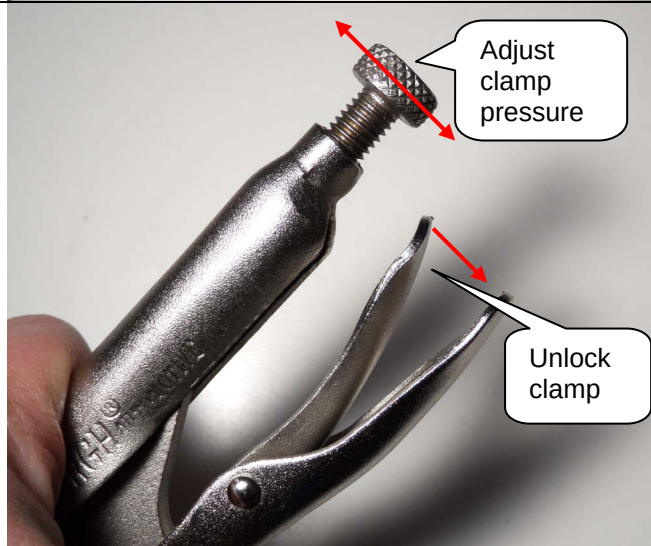


The ThermoSeal material is handled like regular shrink tubing. You will need the following tools: Heat gun, seal clamp and scissors.

All CatLog-S devices are pre-sealed and just need to be sealed on the interface prior to use.

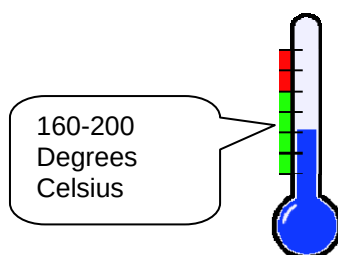
We sell the sealing tool as well as the ThermoSeal material.

Please note that regular shrink tubing will not have the ability to open and close the seal again without compromising the seal tightness.



Before you start adjust the sealing clamp. With the adjustment wheel you set the clamp force. Make the adjustments while the clamp is open, when close the clamp to see the resulting gap size/pressure. The clamp will lock itself in closed position making it very convenient for the later sealing operation. To unlock press the handle lever as indicated in the picture below.

The right adjustment for ThermoSeal is that in closed empty position the jaws still touch each other but the closing pressure is very low.



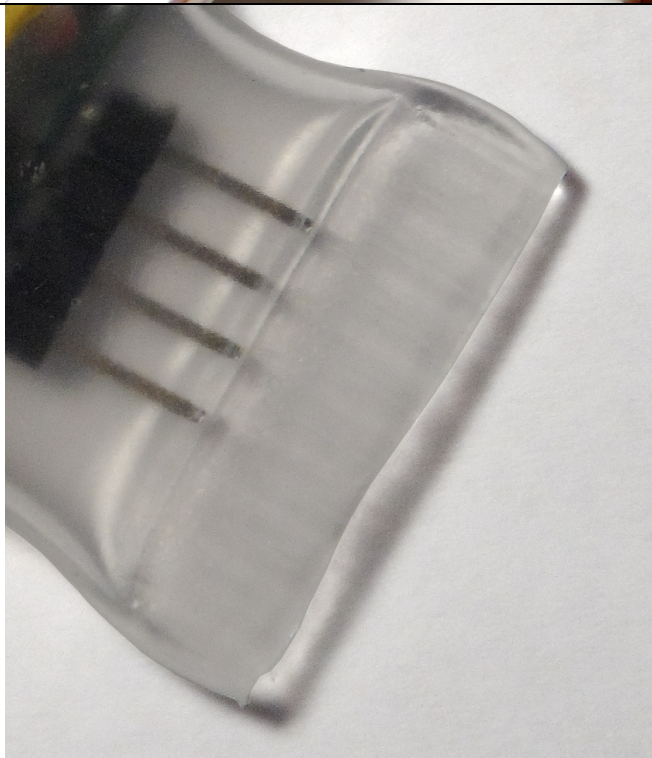
Next step is to adjust the heatgun. The optimal temperature range is 160-200 degrees Celsius (320 – 390 Fahrenheit). If you have an unregulated heatgun you will need to vary the distance between air outlet and device to not overheat the material. You may also want to shield the battery. The battery may get damaged by too high temperatures.



Now heat the material at the sealing location (see red circle in image) from **all sides** until it gets soft and sticky. If you are opening a seal apply heat until the material gets back to the tubular shape. Do not overheat or apply heat for a long period of time. Usually it takes 30s to 1 minute to properly heat the material.



Now quickly take the device, place the seal area between the jaws (center area) and close the clamp. It is important to note to **not clamp parts of the device**.



After about 30-60s you can unlock the clamp and remove the device. In batch operation you will heat the next device while the seal of the previous device cools down. Please remember to let the clamp cool down itself from time to time.

If the seal is closed for the first time you may need the scissors to cut off excess material. The ideal seal width is 5-8mm.